

has been no special hardship due to scarcity. The following table gives the depth of snow on the ground at Summit, Placer County, Cal.:

Years.	Dec. 1.	Dec. 15.	Dec. 31.
	Inches.	Inches.	Inches.
1907.....	0	47	87
1908.....	24	32	21
1909.....	2	24	45
1910.....	7	4	4
1911.....	1	2	56
1912.....	T.	14	19

SUNSHINE.

The following table gives the total hours of sunshine and percentages of the possible:

Stations.	Hours.	Percent- age of possible.	Stations.	Hours.	Percent- age of possible.
Eureka.....	75	26	Sacramento.....	215	73
Fresno.....	230	77	San Diego.....	268	86
Los Angeles.....	276	90	San Francisco.....	192	65
Mount Tamalpais.....	196	66	San Jose.....	225	75
Red Bluff.....	174	60	San Luis Obispo.....	258	85

There was more sunshine during the current December than during the same month last year.

NOTES ON THE RIVERS OF THE SACRAMENTO AND LOWER SAN JOAQUIN WATERSHEDS FOR DECEMBER, 1912.

By N. R. TAYLOR, Local Forecaster.

Sacramento watershed.—The rivers of this watershed were much below the stages usually maintained during December and were even lower than during the preceding month. In some of the reaches of the Sacramento River stages 1 foot lower than those of November were reported.

There was a marked deficiency in rainfall over all sections of the Sacramento Valley, especially in the lower portion, where the rainfall was the lightest on record for December. Rain, mostly light, was general from about the 10th to the 15th and during this period from 15 to 20 inches of snow accumulated in the high ranges of the Sierra Nevada, but the prevailing low temperatures retarded the melting of snow and likewise reduced the run-off of all mountain streams. The greatest rise in any stream during the month was 4.6 feet at Red Bluff during the 24 hours ending at 7 a. m. of the 15th, but this flattened out as it moved downstream and resulted only in a slight swell in the lower reaches of the river.

There was a scarcity of water for mining purposes during the entire month.

Lower San Joaquin watershed.—The rivers of this watershed remained at extreme low stages during the month. The San Joaquin River itself was, with one exception, the lowest of which there is a record for December. Precipitation throughout the drainage basin was light and there was no appreciable increase in the run-off of any of the mountain streams as a result of melting snow.

NOTES ON THE RIVERS OF THE UPPER SAN JOAQUIN WATERSHED.

By W. E. BONNETT, Local Forecaster.

During the month of December there was but one general rain in the watershed of the upper San Joaquin and it was not in sufficient amount to cause any rise in the streams. The stages were very low and uniform through-

out the month with ranges at the various stations of but one or two tenths of a foot.

In many ways the weather of December was like that of the same month last year but the abnormalities were more pronounced. Fewer days with fog were recorded than ever before, the percentage of humidity was the lowest and the number of clear days the greatest of record. These conditions were brought about by the scarcity of rain and resulted in a great daily range of temperature, the day temperatures being somewhat higher than normal and the night temperatures very much lower. There was an unusual succession of heavy to killing frosts with the temperature at the ground 25° or below on 15 days of the month.

OCEAN TEMPERATURES ON CALIFORNIA COAST.

By GEORGE F. McEWEN.

[Summary by author of a paper prepared for the University of California, Department of Zoology.]

The presence along the west coast of North America of a belt of cold surface water having at any point a much lower temperature than is normal for the corresponding latitude has long been known. And several papers have been written in which a diversity of merely qualitative explanations of this interesting and perplexing phenomenon have been given. The present paper is an attempt to explain quantitatively the temperature distribution by means of a new theory of oceanic circulation, developed by V. W. Ekman, of Kristiana.

The contents of this paper fall under the following nine heads:

I. A brief summary of some important and generally accepted facts concerning oceanic temperatures and circulation.

II. A brief review of the theories that have been proposed to account for the cold-water belt along the west coast of North America.

III. An abstract of the most important part of Ekman's theory of oceanic circulation needed in attacking the above-mentioned problems.

IV. Some general qualitative applications of his theory to a variety of temperature problems.

V. The formulation of a temperature problem in such a way that a quantitative estimate of the mean monthly surface-water temperature for any given place can be made by means of the physical theory of heat and circulation.

VI. The solution of the above problem for four very different regions along the Pacific coast, and a comparison of the observed and calculated values.

VII. A discussion of the results, and additional test of the theory using the observations made by the Marine Biological Association of San Diego in a much more limited area.

VIII. Some remarks on the influence of ocean temperatures on the coast climate of California.

IX. Summary and conclusion.

IX. SUMMARY AND CONCLUSIONS.

Numerous observations extending over a long period have established the presence of abnormally cold surface water contiguous to the west coast of North America,

¹ McEwen, Geo. F., The Distribution of Ocean Temperatures Along the West Coast of North America Deduced from Ekman's Theory of the Upwelling of Cold Water from the Adjacent Ocean Depths. Internationale Revue der gesamten Hydrobiologie und Hydrographie, 1912, Band V, Heft 2 und 3, pp. 243-286, 21 text figures, 4 tables.